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DETAILED DESCRIPTION

[Detailed Description of the Invention]**[0001]**

[Field of the Invention] This invention relates to the cleaning blade for removing in more detail the non-transfer toner which remains on the image support surfaces, such as a photo conductor, about the cleaning blade in image forming devices, such as a copying machine of an electrophotography system, a printer, and an electrostatic recording device. This invention relates to the image formation method using the manufacturing method of this cleaning blade, the image forming device provided with this cleaning blade, and this image forming device.

[0002]

[Description of the Prior Art] The image forming device which has composition as shown in drawing 1 as an image forming device provided with the cleaning blade, for example is known. This image forming device is provided with the photo conductor drum 1, the cleaning device 2, the electrification unit 3, the exposure device 4, the developer 5, the transfer device 6, etc. The photo conductor drum 1 is rotated by the direction of the arrow A. With the electrification unit 3, the surface of the photo conductor drum 1 is electrified uniformly and uniformly. The electric charge of an exposure region is vanished and an electrostatic latent image is made to form on the photo conductor drum 1 by the image exposure from the exposure device 4.

[0003] The electrostatic latent image on the photo conductor drum 1 is developed by the developer ("toner for electrostatic charge image development" or it is only called a "toner") supplied from the developer 5, and forms a visible image (toner image). The developer 5 is provided with the developing roll 8 and the toner layer thickness regulating member 9.

The stored toner is supplied to the photo conductor 1 surface.

The toner image of the photo conductor drum 1 surface is transferred on the transfer materials 7, such as a transfer paper, by a transfer device, ranks second, and is sent to an anchorage

device (not shown).

[0004]The photo conductor drum 1 is the image support for supporting an electrostatic latent image and a toner image. Although the toner image on the photo conductor drum 1 is transferred on the transfer material 7 by the transfer device 6, it may remain not having transferred the part. Therefore, the cleaning device 2 removes the non-transfer toner on the photo conductor drum 1. If the following image formation process is performed while non-transfer toner had remained on the photo conductor drum 1, it will be generated by dirt in a picture.

[0005]In the image forming device shown in drawing 1, the cleaning device 2 is provided with the cleaning blade 2a and support member 2b, and is arranged around the photo conductor drum 1. The cleaning blade 2a is arranged so that the tip end part may contact the surface of the photo conductor drum 1. The perspective view of the cleaning blade 2a and support member 2b is shown in drawing 2. The cleaning blade 2a is usually pasted up on support member 2b with adhesives.

[0006]Generally a cleaning blade is the plate formed from elastic body materials, such as rubber and polyurethane. The cleaning blade is contacted with contact pressure with the tip end part (edge) moderate on the image support surface, in order to remove the unestablished toner on image support efficiently. However, the cleaning blade currently formed from elastic body material, although excelled in elasticity, since skin friction resistance is large, if the relation between the contact pressure to image support and frictional force is not balanced, the tip end part will be dragged in the hand of cut of image support, and will bend -- what is called -- "it may be turned over and phenomenon" may arise.

[0007]In order to be turned over and to prevent a phenomenon conventionally, the art which applies the particles excellent in mobility with a particle diameter of 20 micrometers or less to the edge part of a cleaning blade as lubricant is proposed. Various proposals are made also about the applying method which heightens the adhesion power of granular material lubricant to the cleaning-blade surface.

[0008]For example, the lubricant content liquid for which the solution of the portion welded by pressure to the image support of a cleaning blade emulsified or suspended in acrylic resin in part at least was made to distribute granular material lubricant is applied to the patent No. 3112362 gazette, and the method of drying is proposed. In working example of this gazette, the lubricant water content dispersion liquid which made acrylic water emulsified liquid distribute poly TERORA fluoroethylene powder, It is indicated by by making it adhere near the edge part of the cleaning blade made from polyurethane in 6 micrometers (powdered coating weight = equivalent to 0.6 mg/cm^2) of thickness that the coefficient of friction of the edge part obtained the cleaning blade of 0.4.

[0009]An aliphatic hydrocarbon system detergent washes the cleaning blade which pastes up

an elastic body braid on a support member, and before this detergent dries, the method of carrying out sticking-by-pressure spreading of the fluoro-resin system impalpable powder is indicated by JP,H7-266463,A. Without using solvents, such as chlorofluocarbon which poses an environmental sanitation top problem, according to this method, lubricant can be made to be able to adhere to the tip part of a cleaning blade, and frictional force can be reduced.

[0010]The method which applies the lubricant dispersion liquid which made the fluorine system inert liquid object which has surface tension within the limits of specification distribute granular material lubricant to the portion welded by pressure to the image support of a cleaning blade, and it is made to dry is proposed by JP,H8-220962,A. In this gazette, it is indicated that the shape of granular material lubricant has the preferred shape of a ball. The lubricant dispersion liquid which made working example of this gazette distribute a spherical polymethylmethacrylate granular material with a mean particle diameter of 0.5 micrometer in a fluorine system inert liquid object (C_6F_{14}), It is dropped at the edge part of a polyurethane braid, and applies, and it is indicated by by drying that the surface treatment cleaning blade of 0.75 mg/cm^2 was obtained for the coverage of granular material lubricant.

[0011]According to the method of carrying out a surface treatment to such granular material lubricant, moderate lubricity is given to the tip end part in contact with the image support of a cleaning blade, friction with the image support surface is reduced, by it, it is turned over and a phenomenon can be prevented. The cleaning blade which carried out the surface treatment to granular material lubricant can maintain good cleanability over a long period of time comparatively, when it applies to the image forming device which uses pulverized toner as a developer. However, when the cleaning blade by which the surface treatment was carried out to conventional granular material lubricant was applied to the image forming device using the spherical toner obtained by a suspension polymerization method etc., it became clear that it was inferior to cleanability.

[0012]Generally the manufacturing method of a toner can be divided roughly into pulverizing method and the polymerizing method. In pulverizing method, the toner (pulverized toner) is manufactured by carrying out melt kneading of binding resin, colorant, and the other additive components, grinding them, and classifying them. Since particle size distribution is large and non-spherical particles, pulverized toner is easy to be removed by the cleaning blade. On the other hand, since the yield by a classification being bad since it is generated by a lot of impalpable powder in a grinding process, and binding resin of pulverized toner are weak, there are problems, like pulverization is carried out at the time of use, and image quality deteriorates.

[0013]On the other hand, polymerization toner can be obtained as a spherical colored polymer particle which has sharp particle size distribution by distributing the drainage system carrier fluid inside of the body as a minute drop, and, for example, making it carry out suspension

polymerization of a polymerization nature monomer, colorant, and the monomer composition containing other additive components. Namely, the particle size distribution expressed with the ratio (dv/dn) of volume average particle diameter (dv) and number average particle diameters (dn) by controlling polymerization conditions polymerization toner within the limits of 1.0-1.4, . And it can obtain as a spherical colored polymer particle substantially with the sharp particle size distribution which has a degree of sphericity expressed with the ratio (dl/ds) of the major axis (dl) of particles, and a minor axis (ds) within the limits of 1.0-1.3. (For example, JP,H5-188637,A, WO 00/No. 13063 gazette, etc.).

[0014]In order to cope with the demand of improvement in the speed of highly-minute-izing of a picture, and printing speed, full-color-izing, etc. in recent years, (1) volume average particle diameter more preferably 9 micrometers or less 10 micrometers or less to a toner The diameter[of a granule]-ized thing of 8 micrometers or less, Reducing fixing temperature etc. is called for without spoiling having particle size distribution more sharp than (2) and an advanced degree of sphericity and (3) preservation stability.

[0015]In order to fill these demands, diameter[of a granule]-izing of polymerization toner, sharp-ization of particle size distribution, etc. are advanced. In order to obtain the spherical toner in which low temperature fixability and preservation stability balanced, the capsule toner of the core shell mold structure which covered the colored polymer particle with a low glass transition temperature with the polymer layer with a high glass transition temperature by the method of polymerizing in two steps, for example is developed.

[0016]However, cleaning of the unestablished toner which remains on image support is becoming very difficult as diameter[of a granule]-izing of a toner, sharp-izing of particle size distribution, and conglobation are advanced and the low temperature fixability of a toner, preservation stability, endurance, etc. are improved simultaneously. Compared with the non-spherical toner which has broadcloth particle size distribution like pulverized toner, the spherical toner with sharp particle size distribution has the adhesion force of toners, and the dramatically large adhesion force between a toner and image support, and moreover, it increases as a toner diameter[of a granule]-izes these adhesion force. The improvement of a method which removes the unestablished toner on image support in the image formation method using the toner of the diameter of a granule using the cleaning device provided with the cleaning blade in a globular form has come [then,] to be called for.

[0017]It is difficult to fully remove the unestablished toner of the diameter of a granule in the globular form which remains on image support in the cleaning method using the cleaning blade formed from elastic body material. the conventional cleaning blade (the patent No. 3112362 gazette.) which made granular material lubricant excellent in mobility adhere to the tip end part of a cleaning blade in comparatively small coating weight JP,H8-220962,A is difficult to fully remove the unestablished toner of the diameter of a granule in the globular form of what

makes the coefficient of friction of a cleaning blade small, is turned over, and can prevent a phenomenon, and the image soil which originates in cleaning defect with a small number of sheets printed generates it.

[0018]Since an aliphatic hydrocarbon system detergent volatilizes easily, the method (JP,H7-266463,A) of washing a cleaning blade with an aliphatic hydrocarbon system detergent, and carrying out sticking-by-pressure spreading of the fluoro-resin system impalpable powder is difficult to adjust the coating weight of fluoro-resin system impalpable powder primarily, and deficient in it in reproducibility. There is actually no reference about the coating weight of fluoro-resin system impalpable powder in this gazette.

[0019]In order to raise the cleanability of the toner of the diameter of a granule in a globular form, when the addition of abrasive soap, such as a silica particle to a toner, is increased, it may have an adverse effect on development nature or transfer nature. It is not desirable in order for development nature and transfer nature to fall a toner in addition to the manufacturing method of the anomaly-sized toner of the diameter of a granule being difficult for the method of raising cleanability not a globular form but by making it anomaly-ize.

[0020]

[Problem(s) to be Solved by the Invention]Even if the purpose of this invention is a toner of the diameter of a granule in spherical toner, especially a globular form, there is in providing the cleaning blade which can show the cleanability stable over the long period of time.

[0021]Other purposes of this invention are to provide the image formation method using the manufacturing method excellent in the reproducibility of such a cleaning blade, the image forming device provided with this cleaning blade, and this image forming device.

[0022]In order that this invention person may attain said purpose, as a result of inquiring wholeheartedly, on the surface of the portion of a cleaning blade which contacts image support at least. By making particles adhere within the limits of the coating weight 1 per unit area - 10 mg/cm², Even if it was a toner of the diameter of a granule in the globular form that it is turned over and a phenomenon does not happen from the first, cleanability was notably excellent, and preferably, even if it performed continuous printing of 20,000 or more sheets more preferably, 5,000 or more things [10,000 or more] which image soil does not generate were found out. As particles, it is preferred that mean particle diameter is a particle of 0.1 micrometers or more, and it is more preferred that shape is a non-globular form further. This invention comes to be completed based on these knowledge.

[0023]

[Means for Solving the Problem]According to this invention, it is a cleaning blade for removing non-transfer toner on the surface of image support in this way, A cleaning blade, wherein particles have adhered to the surface of a portion of this cleaning blade which contacts image support at least within the limits of the coating weight 1 per unit area - 10 mg/cm² is provided.

[0024]On the surface of a portion of a cleaning blade for removing non-transfer toner on the surface of image support according to this invention which contacts image support at least. After applying a nonionic surfactant and making particles adhere to this spreading side within the limits of the coating weight 1 per unit area - 10 mg/cm², a manufacturing method of a cleaning blade making it dry and by which the surface treatment was carried out is provided.

[0025]In an image forming device with which a cleaning blade for removing non-transfer toner on the surface of image support has been arranged according to this invention, An image forming device, wherein this cleaning blade is a cleaning blade from which particles have adhered to the surface of a portion which contacts image support at least within the limits of the coating weight 1 per unit area - 10 mg/cm² is provided.

[0026]In an image formation method using an image forming device with which a cleaning blade for removing non-transfer toner on the surface of image support has been arranged according to this invention, As this cleaning blade, use a cleaning blade from which particles have adhered to the surface of a portion which contacts image support at least within the limits of the coating weight 1 per unit area - 10 mg/cm², and as a toner, An image formation method using spherical toner is provided.

[0027]

[Embodiment of the Invention]1. Generally as a cleaning-blade cleaning blade, what was formed from elastic body material can be used. As an elastic body material, conjugated diene system rubber; polyurethane, such as butadiene rubber, polyisoprene rubber, and acrylonitrile-butadiene rubber, fluorocarbon rubber, silicone rubber, etc. are mentioned, for example. Also in these, acrylonitrile-butadiene rubber and polyurethane are preferred.

[0028]Although the shape in particular of a cleaning blade is not limited, generally it is preferred that it is a plate which has the length corresponding to the length of the longitudinal direction of image support (for example, photo conductor drum). Although the thickness in particular of a cleaning blade is not limited, it is usually 1.5-2.5 mm preferably 1-3 mm. As for the hardness of a cleaning blade, it is preferred that it is usually within the limits of 40 to 90 degrees by JIS A hardness.

[0029]As shown in drawing 2, the cleaning blade 2a is usually attached to support member 2b by adhesives etc. Support member 2b is attached to the main part of a cleaning device (housing). As shown in drawing 1, the cleaning blade 2a contacts on the surface of image support (photo conductor drum 1), and it is used, but the degree of angle of contact (acute-angle portion) is usually 40 to 70 degrees preferably 30 to 80 degrees.

[0030]2. As particles used in order to make it adhere to a cleaning blade in particle this invention, Polyolefin resin, such as polyethylene and polypropylene; Polytetrafluoroethylene, Fluoro-resin [, such as polyvinylidene fluoride,]; polyester resin [, such as polyethylene

terephthalate,]; -- acrylic resin [, such as polymethylmethacrylate]; -- aromatic vinyl resin [, such as polystyrene]; -- the organic particulates which consist of synthetic resins, such as copolymerization resin [, such as styrene and n-butyl acrylate copolymer,];, are mentioned. As for these organic particulates, it is preferred that they are the pulverized resin particles of a non-globular form produced by grinding resin.

[0031]A toner can be used as particles. It is preferred that it is pulverized toner containing binding resin and colorant of a non-globular form as a toner in this case. Inorganic particles, such as calcium carbonate, calcium phosphate, silica, and a molybdenum sulfide, can be used as particles.

[0032]As for the particles used by this invention, it is preferred that they are non-globular forms, such as an infinite form, a cube, a rectangular parallelepiped, and a polyhedron. Therefore, the particles of a non-globular form obtained by pulverizing method, such as the above-mentioned pulverized resin impalpable powder and pulverized toner, are preferred. It is preferred also about inorganic particles that they are particles of a non-globular form, such as an infinite form and a cube.

[0033]Since the particles generally produced by grinding resin are infinite forms, it is clear that their pulverized resin particles and pulverized toner are non-globular forms. Although it can distinguish by microscope observation, also when the degree of sphericity expressed with the ratio (dl/ds) of the major axis (dl) of particles and a minor axis (ds) exceeds 1.3, it can check that particles are non-globular forms.

[0034]The mean particle diameter of the particles used by this invention is 0.1 micrometers or more preferably. The mean particle diameter of particles can obtain more preferably 0.1-20 micrometers of 0.3-15 micrometers, especially a desirable result good at about 0.5-10 micrometers, still more preferably. Put particles into water, neutral detergent was made to distribute, and the mean particle diameter of particles measured the dispersion liquid using laser type particle-size-distribution measuring apparatus (the Nikkiso Co., Ltd. make, micro track FRA).

[0035]3. The cleaning blade of manufacturing method this invention of a surface treatment cleaning blade, It can manufacture by the method of making particles adhering to the surface of the portion of the cleaning blade for removing the non-transfer toner on the surface of image support which contacts image support at least within the limits of the coating weight 1 per unit area - 10 mg/cm².

[0036]As a concrete method to which particles are made to adhere, various organic solvents, a surface-active agent, an acrylic emulsion, acrylic dispersion, etc. are made to distribute particles, dispersion liquid are prepared, for example, these dispersion liquid can be applied to the predetermined part of image support, and the method of drying can be adopted. On the surface of the portion of the cleaning blade for removing the non-transfer toner on the surface

of image support also in these which contacts image support at least. After applying a nonionic surfactant and making particles adhere to this spreading side within the limits of the coating weight 1 per unit area - 10 mg/cm², the method of drying is preferred.

[0037]If a volatile organic solvent is used, it is difficult to apply impalpable powder with sufficient reproducibility and to make it adhere quantitatively. On the other hand, by using a nonionic surfactant with weak volatility, impalpable powder can be applied with quantitatively and sufficient reproducibility, and can be made to adhere, and, moreover, the adverse effect to the electrifying characteristic of a toner, etc. can be inhibited. As a nonionic surfactant, commercial neutral detergent can be used conveniently.

[0038]The manufacturing method with a preferred cleaning blade in which the surface treatment was carried out by particles, It is a method which contact to particles where humidity of the nonionic surfactant is applied and carried out, and apply to abbreviated homogeneity, and 30-90 ** of surfaces of the portion of a cleaning blade which contacts image support at least are made to usually dry at the temperature of 35-60 ** preferably after an appropriate time. Desiccation is usually performed under the dry heat atmosphere in an oven etc.

[0039]The purpose can be attained by not making particles adhere all over a cleaning blade, and making it usually adhere to the tip end part in contact with image support, and its peripheral part. the coating weight of the particles to the cleaning-blade surface -- 1 per unit area - 10 mg/cm² -- it is within the limits of 1 - 9 mg/cm² preferably, and, in many cases, a good result can be obtained within the limits of 1.2 - 9 mg/cm².

[0040]4. The image forming device of image forming device this invention is an image forming device with which the cleaning blade for removing the non-transfer toner on the surface of image support has been arranged. Particles have adhered to the surface of a portion on which a cleaning blade contacts image support at least within the limits of the coating weight 1 per unit area - 10 mg/cm².

[0041]The image forming device of this invention will not be limited in particular for other structures if it has such a cleaning blade. For example, although drawing 1 is a sectional view of an example of an image forming device which used one ingredient of nonmagnetic developer, it includes the image forming device which has such a structure in this invention.

[0042]As an image forming device of this invention, three sets of developers are arranged, cyanogen, yellow, and the color toner colored each color tone of magenta are put into the each, and the color image forming device in which a color picture can be made to form is also included. The color image forming device which has arranged the 4th set of the developers into which black toner was put is also included by the image forming device of this invention.

[0043]More concretely as a color image forming device, (1) The multiplex development system which makes a multicolor toner image develop on a photo conductor drum (image support) and

to which package transfer of it is carried out on a transfer material. And there are some which adopted the all directions type of the multiple transfer method which only the number of the colors of color toner repeats the process which makes (2) photo-conductor drum lifting develop only a monochromatic toner image, and is made to transfer on a transfer material, and performs it. The transfer drum method which twists a transfer material around a (i) transfer drum, and transfers for every color to a multiple transfer method, (ii) After performing primarily transferring for every color on the intermediate transfer body and making a multicolor picture form on an intermediate transfer material, There is a tandem system which arranges to a tandem two or more image formation parts containing the intermediate transfer system which bundles up and performs secondary transfer on a transfer material, and a (iii) photo conductor drum and a developer, carries out adsorption conveyance of the transfer material with a transfer conveying belt, and makes each color transfer on a transfer material one by one. In order to perform image formation at high speed, the image forming device of a tandem system is preferred.

[0044]Only the number of the colors which the image formation part from which the laser irradiation apparatus, the photo conductor drum, the developer, and the cleaning device became a set uses as a color image forming device of a tandem system, for example of what is arranged in order is preferred. Each image formation part is usually arranged in order of each toner of yellow, magenta, cyanogen, and black along with the transportation belt. A transfer material is conveyed with a transportation belt, and the picture of each color formed of each image formation part is piled up one by one, it is transferred, and it is fixed to it. It can stick to a transfer drum and a transfer material can also be made to convey, although being conveyed with a transportation belt is common.

[0045]5. A picture can be formed using the image forming device equipped with the cleaning blade of the image formation method above-mentioned. In the image formation method using the image forming device with which the cleaning blade for the image formation method of this invention to remove the non-transfer toner on the surface of image support has been arranged, As this cleaning blade, use the cleaning blade from which particles have adhered to the surface of the portion which contacts image support at least within the limits of the coating weight 1 per unit area - 10 mg/cm², and as a toner, It is an image formation method using spherical toner.

[0046]The method of using the image forming device shown in drawing 1 as an example of the image formation method of this invention is mentioned. First, the surface of the photo conductor drum 1 is electrified uniformly and uniformly with the electrification unit 3. It exposes on the surface of this photo conductor drum 1 with the exposure device 4, and an electrostatic latent image is formed in it. In the developer 5, a toner is supplied with the developing roll 8. As for the toner to supply, thickness is adjusted by the toner layer thickness regulating member 9.

With the supplied toner, the electrostatic latent image on the photo conductor drum 1 is developed by the visible image (toner image). The toner image on the photo conductor drum 1 is transferred on the transfer material 7 by the transfer device 6. The toner image transferred on the transfer material 7 is sent to a fixing process, and is fixed by heat pressing etc. on the transfer material 7.

[0047]In order to form a color picture, the various colors which adopted the above-mentioned tandem system etc. use a ***** device. In this case, it is preferred that it is the spherical toner colored the color tone chosen from cyanogen, yellow, magenta, and black as spherical toner.

[0048]6. The image forming device using usual pulverized toner, polymerization toner, etc. as a developer ingredient can be equipped with the cleaning blade of toner this invention for electrostatic charge image development as a toner for electrostatic charge image

development, and the cleanability outstanding by it can be acquired. Of course, a cleaning blade is turned over at the time of operation, and a phenomenon is not generated, either.

[0049]The outstanding cleanability can be demonstrated even if it uses the spherical toner in which the image forming device provided with the cleaning blade and this cleaning blade of this invention has the sharp particle size distribution of polymerization toner etc. Even if it uses the toner of the diameter of a granule in a globular form, cleanability does not fall. Then, such spherical toner is explained.

[0050]Generally spherical toner can be obtained by the polymerizing method. As a polymerizing method, an emulsion polymerization method, a condensation method, the distributed polymerizing method, a suspension polymerization method, etc. are mentioned. According to such a polymerizing method, the particle toner of micron order can be directly obtained by comparatively small particle size distribution. Spherical toner may be capsule toner which has the core shell mold structure in which the polymer enveloping layer was formed on the surface of the colored polymer particle. As for spherical toner, it is preferred especially from a viewpoint of the developer characteristic that it is polymerization toner obtained by suspension polymerization. Capsule toner makes the colored polymer particle which serves as a core by suspension polymerization generate, It is preferred to be obtained by the method of polymerizing the polymerization nature monomer used as shell under existence of this colored polymer particle, and making the core shell type polymer particle in which the polymer layer which covers this colored polymer particle was formed generating.

[0051]Although the volume average particle diameter (dv) of spherical toner (capsule toner is included) can be chosen from the range of 2-30 micrometers, it is usually about 2-15 micrometers. In order to acquire a high-definition picture, it is preferred that it is spherical toner of the diameter of a granule. 2-10 micrometers of volume average particle diameter [4-9 micrometers of] of the spherical toner of the diameter of a granule are 5-8 micrometers especially preferably more preferably. Although the particle size distribution (dv/dp) expressed

with the ratio of the volume average particle diameter (dv) of spherical toner and number average particle diameters (dp) is usually 1.6 or less, in the case of the spherical toner which has more sharp particle size distribution, the particle size distribution is 1.3 or less preferably. the degree of sphericity to which spherical toner is expressed with the ratio (dl/ds) of a major axis (dl) and a minor axis (ds) -- usually -- 1-1.3 -- it is 1-1.2 preferably.

[0052]In the capsule toner which has core shell mold structure, 0.003-0.5 micrometer of average thickness of shell is 0.001-1.0 micrometer usually 0.005-0.2 micrometer more preferably. When the thickness of shell is too large, fixability shows a fall tendency, and if too small, the improvement effect of preservability will become small.

[0053]The polymerization toner by suspension polymerization can be obtained by carrying out suspension polymerization of the polymerization nature monomer composition which contains a polymerization nature monomer and colorant at least in the drainage system carrier fluid body containing dispersion stabilizer. The polymer which a polymerization nature monomer polymerizes and generates serves as binding resin. Although the capsule toner with core shell mold structure can be manufactured by methods, such as the spray dry method, an interface reaction method, an in situ polymerization method, and a phase separation method, especially an in situ polymerization method and a phase separation method have well preferred manufacturing efficiency.

[0054]By the polymerizing method, in the drainage system carrier fluid body containing dispersion stabilizer, at least concretely A polymerization nature monomer, Capsule toner can be obtained by using as a core the colored polymer particle obtained by carrying out suspension polymerization of the polymerization nature monomer composition containing colorant and a softener, and carrying out suspension polymerization of the polymerization nature monomer for shell under existence of this core. The polymer layer formed by the monomer for shell polymerizing turns into an enveloping layer.

[0055]Various additive agents, such as a cross-linking monomer, a macro monomer, a regulator, a charge controlling agent, a general-purpose release agent, lubricant, and a distributed auxiliary agent, can be included in a polymerization nature monomer composition if needed.

[0056]As a polymerization nature monomer, a monovinyl system monomer is preferred. Specifically Styrene monomer; acrylic acid, such as styrene, vinyltoluene, and alpha-methylstyrene, Methacrylic acid; Methyl acrylate, ethyl acrylate, acrylic acid propyl, Butyl acrylate, 2-ethylhexyl acrylate, acrylic acid dimethylaminoethyl, Methyl methacrylate, ethyl methacrylate, methacrylic acid propyl, Butyl methacrylate, 2-ethylhexyl methacrylate, dimethylaminoethyl methacrylate, The derivative of acrylic acid, such as acrylonitrile, a methacrylonitrile, acrylamide, and methacrylamide, or methacrylic acid; Ethylene, Ethylenic unsaturation monoolefins, such as propylene and butylene; VCM/PVC, Vinylic halide, such as

vinylidene chloride, vinyl, fluoridation; Vinyl acetate, Vinyl ester, such as vinyl propionate; Vinyl ether; vinyl methyl ketone, such as vinylmethyl ether and vinylethyl ether, Vinyl ketone, such as methyliso propenyl ketone; nitrogen-containing vinyl compound [, such as 2-vinylpyridine, 4-vinylpyridine, and N-vinyl pyrrolidone,]; etc. are mentioned.

[0057]A monovinyl system monomer is independent, respectively, or can be used combining two or more sorts of monomers. As a monovinyl system monomer, it is preferred to use together a styrene monomer and the derivative of acrylic acid (meta).

[0058]If a cross-linking monomer and/or a cross-linking polymer are used with a polymerization nature monomer, it is effective in a hot offset improvement. A cross-linking monomer is a monomer which has a carbon-carbon unsaturated double bond in which two or more polymerizations are possible. A cross-linking polymer is a polymer which has a carbon-carbon unsaturated double bond in which two or more polymerizations are possible. If a macro monomer is used with a polymerization nature monomer, balance of preservability, offset tightness, low temperature fixability, etc. can be improved.

[0059]As colorant, the various paints and color which are used in the field of toners, such as carbon black and a titanium white, can be used. As black colorant, magnetic particle [, such as carbon black, the dyes-and-pigments; cobalt of the Nigrosine base, nickel, a tri-iron tetraoxide, iron oxide manganese, iron oxide zinc, and iron oxide nickel,]; etc. can be mentioned. When using carbon black, since good image quality will be obtained and the safety to the environment of a toner will also increase if primary particle diameter uses what is 20-40 nm, it is desirable. As colorant for color toner, a yellow coloring agent, a magenta coloring agent, cyanogen colorant, etc. can be used.

[0060]In order to raise the electrostatic property of a toner, it is preferred to make a positive triboelectric charging or negative triboelectric charging charge controlling agent contain in a monomer composition. As a charge controlling agent, the metal complex of the organic compound which has a carboxyl group or a nitrogen-containing basis, metallized dye, Nigrosine, electrification control resin, etc. are mentioned, for example. A toner may be made to contain various release agents for the purpose, such as improvement in the mold releasability at the time of the prevention from offset, or hot calender roll fixing.

[0061]As a polymerization initiator, a radical polymerization initiator is used suitably. As a polymerization initiator, an oil-soluble radical initiator meltable to a polymerization nature monomer is preferred, and can also use a water-soluble initiator together with this if needed.

[0062]As dispersion stabilizer, sulfate; barium carbonate, such as barium sulfate and calcium sulfate, Phosphates, such as carbonate; calcium phosphate, such as calcium carbonate and magnesium carbonate; An aluminum oxide, Metallic oxides, such as titanium oxide; Aluminium hydroxide, magnesium hydroxide, Metal hydroxide, such as a ferric hydroxide; surface-active agent [, such as water soluble polymer; anionic surface-active agents, such as polyvinyl

alcohol, methyl cellulose, and gelatin, a nonionic surface-active agent, and an amphotytic surface active agent,]; etc. can be mentioned. Also in these, metallic compounds, such as sulfate, carbonate, a metallic oxide, and metal hydroxide, are preferred, and colloid of the metallic compounds of difficulty water solubility is more preferred. Since especially colloid of metal hydroxide of difficulty water solubility can narrow particle size distribution of particle toner and its clear nature of a picture improves, it is preferred.

[0063]Colloid of the metal hydroxide of difficulty water solubility obtained by adjusting the pH of the solution of a water-soluble polyvalent metal compound to seven or more although colloid of difficulty water soluble metallic compounds does not have the restriction by the process, Colloid of the metal hydroxide of difficulty water solubility especially generated by the reaction in the aqueous phase of a water-soluble polyvalent metal compound and hydroxylation alkali metal salt is preferred. The number particle size distribution D50 (50% accumulated of number particle size distribution) is 0.5 micrometer or less, and, as for difficulty water-soluble-metallic-compounds colloid, it is preferred that D90 (90% accumulated of number particle size distribution) is 1 micrometer or less. If the particle diameter of colloid becomes large too much, the stability of a polymerization will collapse or the preservability of a toner will fall.

[0064]Mix a polymerization nature monomer, colorant, and other additive agents (a charge controlling agent, a release agent, etc.), it is made to distribute uniformly using a bead mill etc., and the polymerization nature monomer composition which is oily mixed liquor is prepared. Subsequently, a polymerization nature monomer composition is thrown into the drainage system carrier fluid inside of the body containing dispersion stabilizer, and is stirred with an agitator. After the particle diameter of the drop of a polymerization nature monomer composition becomes fixed, a polymerization initiator is supplied and it is made to shift into the drop of a polymerization nature monomer composition.

[0065]Next, the drop of a polymerization nature monomer composition is corning even to a still more detailed drop using the mixed device which has high shearing. After corning even to the detailed drop which has the particle diameter of the grade which matches mostly in the particle diameter of the polymerization toner to generate, 5-120 ** is usually preferably polymerized at the temperature of 35-95 **. After preparing the drainage system carrier fluid object which contains the drop of said polymerization nature monomer composition within another container or a mixed device, it teaches a polymerization reaction machine and polymerizing is preferred. Thus, a colored polymer particle is made to generate. The generated colored polymer particle is used as polymerization toner after recovery.

[0066]Preferably, although it can manufacture with an in situ polymerization method, if a water-soluble polymerization initiator is added when the capsule toner which has core shell mold structure adds the polymerization nature monomer for shell in a polymerization reaction system, it will become easy to generate the polymer particle which has core shell mold

structure.

[0067]The thing same as a polymerization nature monomer for cores used for this invention as the polymerization nature monomer mentioned above can be illustrated. Especially, that in which glass transition temperature can usually form 60 ** or less of 40-60 ** polymers preferably is preferred. If the glass transition temperature of the polymer component which forms a core is too high, fixing temperature will become high, and if too low, preservability will fall. The polymerization nature monomer for cores is used combining two or more sorts of monomers in many cases, in order to adjust glass transition temperature. The polymerization nature monomer for shell is added to the obtained core particle, and the shell layer of capsule toner is formed in it by polymerizing again.

[0068]As for the polymerization nature monomer for shell, it is preferred that it is what can form the polymer which has a glass transition temperature higher than the glass transition temperature of the polymer which constitutes a core particle. It is preferred to use two or more sorts of polymerization nature monomers which can usually form a polymer with glass transition temperature of greater than 80 **, such as styrene and methyl methacrylate, as a polymerization nature monomer which forms shell, being independent, respectively or combining them.

[0069]By setting up so that the glass transition temperature of the polymer which consists of a polymerization nature monomer for shell may become higher than the glass transition temperature of the polymer which consists of a polymerization nature monomer for core particles at least, the fixing temperature of the polymerization toner to generate can be lowered, and preservation stability can be improved. The glass transition temperature of the polymer obtained by the polymerization nature monomer for shell of 110 ** or less of excess of 60 ** is [120 ** or less of excess of usual / 50 ** of / from a viewpoint of the preservation stability of polymerization toner] 105 ** or less of excess of 80 ** more preferably.

[0070]Not less than 20 ** of differences of the glass transition temperature between the polymer which consists of a polymerization nature monomer for cores, and the polymer which consists of a polymerization nature monomer for shell are not less than 10 ** usually not less than 30 ** more preferably.

[0071]The using rate of the polymerization nature monomer for cores and the polymerization nature monomer for shell is usually 80:20 to 99.9:0.1 (weight ratio). A preservability improvement effect becomes small as too little [the rate of the polymerization nature monomer for shell], and the improvement effect of the reduction of fixing temperature by being excessive becomes small.

[0072]When using polymerization toner as an one ingredient of nonmagnetic developer, an external additive can be mixed if needed. As an external additive, the inorganic particle and organic resin particles which act as a plasticizer, abrasive soap, etc. are mentioned.

[0073]As an inorganic particle, a silica dioxide (silica), calcium carbonate, an aluminum oxide (alumina), titanium oxide, a zinc oxide, tin oxide, barium titanate, strontium titanate, etc. are mentioned, for example. As organic resin particles, methacrylate polymer particles, acrylic ester polymer particles, The core shell type particles etc. in which styrene methacrylic-acid-ester copolymer particles, styrene acrylic ester copolymer particles, and a core were formed in with the methacrylic-acid-ester copolymer, and shell was formed with the styrene polymer are mentioned.

[0074]

[Example]Although working example and a comparative example are given to below and this invention is explained still more concretely, this invention is not limited only to these working example. And % is a weight reference as long as there is no notice especially. The measuring method of physical properties is as follows.

[0075](1) The ratio (dv/dp) with particle diameter, the volume average particle diameter (dv) of particle-size-distribution particles and particle size distribution, i.e., volume average particle diameter, and number average particle diameters (dp) was measured by the multi-sizer (made by Beckman Coulter). Measurement by a multi-sizer was performed on the conditions of the diameter of an aperture of 100 micrometers, the medium iso ton II, and the 100,000 measurement-particles number.

[0076](2) The degree of sphericity of particles, such as a degree-of-sphericity toner, was measured as a value (rl/rs) which took the photograph of particles with the scanning electron microscope, read the photograph with the nexus 9000 type image processing device, and broke the major axis (rl) of particles by the minor axis (rs). The measurement number could be 100 pieces.

[0077](3) The volume resistivity of the volume resistivity toner was measured under with the temperature of 30 **, and a frequency of 1 kHz conditions using the dielectric loss measuring instrument (trade name: TRS-10 type, the Ando Electric Co., Ltd. make).

[0078](4) The cleaning blade was removed from the commercial printer using cleanliness pulverized toner, and after the cleaning blade made particles adhere to the surface in contact with a photo conductor, the printer was equipped again. The number of sheets printed which performs continuous printing with the printed pattern of half-tone with the polymerization toner of the diameter of a granule in the globular form which has core shell mold structure using this printer, and dirt generates with cleaning defect was measured. That out of which cleaning defect does not come even if it prints 20,000 sheets stopped printing by 20,000 sheets. About others, the number of sheets at the time of dirt being checked by the picture was counted.

[0079][Working example 1]

1. Grinding styrene 82% of colorant, and n-butyl acrylate 11%, To 100 copies of electrification control resin (the weight average molecular weight 12,000, glass transition temperature of 67

**) which comprises methacrylic acid dimethylamino benzyl chloride 7%, 24 copies of toluene and six copies of methanol were distributed, and it kneaded with 2 rolls, cooling, without warming. After electrification control resin coiled, it added gradually, and 100 copies of magenta pigments (C. I. pigment red 122; client company make) were kneaded and distributed. The mill opening was 1 mm the first stage, extended the gap gradually and extended it to 3 mm. Mixing time required 1 hour. The organic solvent was added in several steps according to the kneading state of electrification control resin.

[0080] Sampled after kneading the electrification control resin which carried out pigment dispersion, and it was made to dissolve in toluene, and was made the 5% solution of toluene. On the glass plate, the gap made the toluene solution cast with the doctor blade which is 30 micrometers, made it dry, and produced the sheet. About this sheet, when the dispersion state of paints was observed with the optical microscope (magnification 400), larger paints than 0.1 micrometer were not seen with 100-micrometer square of a view.

[0081] 2. In the solution which dissolved 9.8 copies of magnesium chlorides (water-soluble polyvalent metallic salt) in 250 copies of preparation ion exchange water of the colloidal solution, the solution which dissolved 6.9 copies of sodium hydroxide in 50 copies of ion exchange water is gradually added under stirring, Magnesium hydroxide colloid (metal hydroxide colloid of difficulty water solubility) dispersion liquid were prepared. The number average particle diameters D50 (50% accumulated of number particle size distribution) of the generated colloid were 0.36 micrometer, and D90 (90% accumulated of number particle size distribution) was 0.68 micrometer. Particle size distribution was measured with the particle-size-distribution measuring device (a SALD2000A type, the Shimadzu Corp. make). Particle-size-distribution measurement was performed on condition of the carrier fluid =10% salt solution at the time of drop measurement for [refractive-index =1.55-0.20i and ultrasonic-exposure-time =] 5 minutes.

[0082] 3. Polymerization nature monomer for cores which consists of 80.5 copies of monomer composition styrene for cores, and 19.5 copies of n-butyl acrylate (a total of 100 copies), 12 copies of electrification control resin which distributed the aforementioned colorant pigment red 122, It stirred and mixed, uniform dispersion of 0.7 copy of divinylbenzene, one copy of TORIISO butyl mercaptan, one copy of tetraethylthiuram disulfide, and ten copies of dipentaerythritol hexa MIRISUTE rates was carried out, and the monomer composition for cores was obtained.

[0083] 4. Two copies of water dispersion methyl methacrylate (calculation Tg = 105 **) and 100 copies of water of the monomer for shell were micro-disperse--ization-processed with the ultrasonic emulsification machine, and the water dispersion of the monomer for shell was obtained. D90 was 1.6 micrometers when the particle diameter of the drop of the monomer for shell was measured by (a SALD2000A type and the Shimadzu Corp. make).

[0084]5. In the magnesium hydroxide colloidal dispersion liquid obtained with the manufacture above of capsule toner. Throw in said monomer composition for cores, stir until a drop is stabilized, and there, Quantity shearing stirring during 30 minutes was carried out at the number of rotations of 15,000 rpm using EBARAMAIRUDA after adding six copies of t-butylperoxy2-ethylhexanoate (par butyl O by Nippon Oil & Fats Co., Ltd.) of a polymerization initiator, and the drop of the monomer composition was corned. When put the water dispersion of this corned monomer composition into the reactor of 10L equipped with stirring wings, a polymerization reaction was made to start at 90 ** and polymerization conversion reached to about 100%, it sampled and the particle diameter of the polymer particle (core) was measured. As a result, the mean particle diameter of the core was 7.4 micrometers.

[0085]The water dispersion and the water-soluble initiator (Wako Pure Chem make, trade name VA-086;2, and 2'-azobis) of said polymerization nature monomer for shell [The 2-methyl-N -(2-hydroxy ethyl)- propionamide] 0.2 copy was dissolved in 65 copies of distilled water, and it was put into the reactor. After continuing a polymerization for 8 hours, the reaction was suspended and the water dispersion of pH 9.5 polymer particle was obtained.

[0086]After making pH of the system or less into five with sulfuric acid, performing acid cleaning (for 25 ** and 10 minutes) and filtration separating water, stirring the water dispersion of the polymer particle obtained with the above, 500 copies of ion exchange water was newly added and re-slurred, and backwashing by water was performed. Then, after carrying out by having repeated drying and backwashing by water several times again and carrying out filtering separation of the solid content, the dryer performed 2 day-and-night desiccation at 45 **, and the polymer particle was obtained.

[0087]The volume average particle diameter (dv) which took out and measured the dry polymer particle was 7.4 micrometers, and volume-average-particle-diameter (dv) / number average particle diameters (dp) were 1.23. Degree-of-sphericity r_l/r_s was 1.1 and toluene insoluble content was 58%.

[0088]6. 0.6 copy of colloidal silica (trade name: RX-300, product made by Japanese Aerosil) which carried out hydrophobing processing at 100 copies of polymer particles obtained with the preparation above of the developer, and calcium carbonate (the Maruo Calcium Co., Ltd. make.) with a mean particle diameter of 0.3 micrometer 0.3 copy of CUBE-03BHS was added, it mixed using the Henschel mixer, and one ingredient of nonmagnetic developer was prepared. Thus, when the volume resistivity of obtained one ingredient of nonmagnetic developer was measured, it was 12.2 (log ohm-cm).

[0089]7. Surface treatment polyester resin (the Arakawa Chemical Industries, Ltd. make, Luna pale 1416;Tg = 62 **, acid value =8, hydroxyl value =14, molecular-weight-distribution Mw/Mn=8600/3500=2.5) of the cleaning blade was kneaded, and with the roll temperature of 110 **, crushing was carried out and it pulverized further after cooling. Grinding polyester resin

particles were classified and the infinite form resin particulate with a mean particle diameter of 3 micrometers was obtained. On the other hand, with commercial one ingredient of nonmagnetic development system, the color printer of the type developed using pulverized toner was ordered, and the cleaning blade for photo conductors (angle =55 degree of a cleaning blade to product made from polyurethane and JIS A hardness =65 and a photo conductor, thickness = 2 mm) was taken out. Isopropyl alcohol washed the surface of this cleaning blade, and the side which contacts 2 mm of tip smooth sections and the photo conductor of a cleaning blade in neutral detergent (the Fuji Photo Film Co., Ltd. make, trade name drywell) was thinly applied to 5-mm width after desiccation.

[0090]The aforementioned infinite form resin particulate was applied and applied to the cleaning-blade surface which got wet with neutral detergent. When the thickness of the adhering resin particulate was uneven, a cleaning blade is struck lightly, a shock is given and it was made to remove from a thick place. Then, it dried at 40 ** in the dryer one whole day and night, and the resin particulate was fixed to the cleaning-blade surface.

[0091]Weighing of the weight (a) of a cleaning blade was carried out after desiccation. After stripping off the resin particulate which adhered to cleaning-blade tip smooth sections (2 mm in width) using the cutter knife wiped with methanol over 5 cm in length, weighing of the weight (b) of a cleaning blade was carried out. When the coating weight per unit area of a resin particulate was calculated from the weight differences (a-b) of the cleaning blade, the coating weight of the resin particulate was 4.7mg/cm².

[0092]8. Evaluation, thus the obtained cleaning blade of cleanability were returned to the cleaning device. Pulverized toner was picked out from the developer containing pulverized toner, and it exchanged for the capsule toner by the polymerizing method manufactured previously. Continuous printing evaluation was performed using capsule toner. The result was shown in Table 1. In evaluation of cleanability, in the image evaluation as which generating of dirt was not regarded, even the continuous printing of the color tone of 20,000 sheets could be good, its image concentration could be high, and the very good picture without fogging might be after 20,000-sheet printing.

[0093][Working example 2] It replaces with grinding polyester resin particles as particles made to adhere on a cleaning blade, Styrene acrylate resin (the Arakawa Chemical Industries, Ltd. make, Luna pale ST-1;Tg = 65 **) Acid value =13 and molecular-weight-distribution Mw/Mn=110000/8000=13.7 are ground, The pulverized resin particles (mean particle diameter of 5 micrometers) of the infinite form acquired by classifying were used, except having changed the coating weight per the unit area into 1.2 mg/cm², the cleaning blade to which particles adhered was created like working example 1, and continuous printing evaluation was performed. A result is shown in Table 1.

[0094][Working example 3] It replaces with grinding polyester resin particles as particles made

to adhere on a cleaning blade, Use cube-like calcium carbonate (mean particle diameter of 5 micrometers; the Maruo Calcium Co., Ltd. make, CUBE-50BHS), and it is made to be the same as that of working example 1 except having changed the coating weight per the unit area into 8.7 mg/cm^2 , The cleaning blade to which particles adhered was created and continuous printing evaluation was performed. A result is shown in Table 1.

[0095][Working example 4] It replaces with grinding polyester resin particles as particles made to adhere on a cleaning blade, 100 copies of styrene acrylate resin (the Arakawa Chemical Industries, Ltd. make, Luna pale ST-1) -- carbon black (the Mitsubishi Chemical make.) #25) Carry out melt kneading of six copies and two copies of charge controlling agents (the Hodogaya chemical industry company make, SUPIRON black TRH) at 110 ** with a roll, The pulverized toner (mean particle diameter of 9 micrometers) of the infinite form which ground and was acquired by classifying was used, except having changed the coating weight per the unit area into 2.8 mg/cm^2 , the cleaning blade to which particles adhered was created like working example 1, and continuous printing evaluation was performed. A result is shown in Table 1.

[0096][Comparative example 1] It is made to be the same as that of working example 1 except having changed into 0.8 mg/cm^2 ^{from 4.7 mg/cm^2} the coating weight per unit area of the grinding polyester resin particles made to adhere on a cleaning blade, The cleaning blade to which particles adhered was created and continuous printing evaluation was performed. A result is shown in Table 1.

[0097][Comparative example 2] It is made to be the same as that of working example 1 except having changed into 11.2 mg/cm^2 ^{from 4.7 mg/cm^2} the coating weight per unit area of the grinding polyester resin particles made to adhere on a cleaning blade, The cleaning blade to which particles adhered was created and continuous printing evaluation was performed. A result is shown in Table 1.

[0098][Comparative example 3] It replaces with grinding polyester resin particles as particles made to adhere on a cleaning blade, Use infinite form silica (the product made by Japanese Aerosil, RX-50) with a mean particle diameter of 0.04 micrometer, and it is made to be the same as that of working example 1 except having changed the coating weight per the unit area into 0.3 mg/cm^2 ^{from 4.7 mg/cm^2} , The cleaning blade to which particles adhered was created and continuous printing evaluation was performed. A result is shown in Table 1.

[0099][Comparative example 4] It replaces with grinding polyester resin particles as particles made to adhere on a cleaning blade, a spherical polymethyl-methacrylate-resin particle (the Soken Chemical & Engineering make.) with a mean particle diameter of 0.4 micrometer A trade name "MP1000] was used, except having changed the coating weight per the unit area

into 0.8 mg/cm^2 from 4.7 mg/cm^2 , the cleaning blade to which particles adhered was created like working example 1, and continuous printing evaluation was performed. A result is shown in Table 1.

[0100]

[Table 1]

表 1

	微粒子			ブレード上への 微粒子の付着量 (mg/cm ²)	クリーニング性 (印字枚数)
	種類	形状	粒径(μm)		
実施例 1	ポリエステル樹脂	不定形	3	4.7	20,000 枚で問題なし
実施例 2	スチレン・アクリレート樹脂	不定形	5	1.2	20,000 枚で問題なし
実施例 3	炭酸カルシウム	キュウブ	5	8.7	20,000 枚で問題なし
実施例 4	粉碎トナー	不定形	9	2.8	20,000 枚で問題なし
比較例 1	ポリエステル樹脂	不定形	3	0.8	4,000 枚で クリーニング不良
比較例 2	ポリエステル樹脂	不定形	3	11.2	1,000 枚以下で クリーニング不良
比較例 3	シリカ	不定形	0.04	0.3	1,000 枚以下で クリーニング不良
比較例 4	PMMA樹脂粒子	球形	0.5	0.8	1,000 枚で クリーニング不良

[0101]

[Effect of the Invention] According to this invention, even if it is a toner of the diameter of a granule in spherical toner, especially a globular form, the cleaning blade which can show the cleanability stable over the long period of time is provided. In this invention, neutral detergent (nonionic surfactant) is used as a coating medium.

Therefore, the cleaning blade excellent in cleanability can be manufactured with sufficient reproducibility.

According to this invention, the image forming device provided with such a cleaning blade is provided.

[0102] Since the outstanding cleanability can be demonstrated even if it is a case where the toner of the diameter of a granule is used in spherical toner, especially a globular form if the cleaning blade of this invention is used, The high-definition picture which did not need to anomaly-ize shape of the toner, or did not need to increase the quantity of abrasive soap, and was excellent in development nature and transfer nature as a result can be formed.

[Translation done.]